Benefit-Cost Analysis for Distributed Energy Resources In New York

A Framework for Accounting for All Relevant Costs and Benefits

Prepared for Advanced Energy Economy Institute

October 2, 2014

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Acknowledgements

- Full report:

  Tim Woolf et al., *Benefit-Cost Analysis for Distributed Energy Resources: A Framework for Accounting for All Relevant Costs and Benefits* (Synapse Energy Economics, prepared for the Advanced Energy Economy Institute, September 22, 2014).

  http://info.aee.net/benefit-cost-analysis-for-der-synapse or
  http://synapse-energy.com/project/benefit-cost-analysis-distributed-energy-resources

- Research supported by the Rockefeller Brothers Fund and the Energy Foundation

New York Reforming the Energy Vision

- The REV docket sets out a comprehensive, ambitious, and forward-thinking vision for the New York electric system.

- The benefit-cost analysis is the backbone of the initiative that will enable New York to achieve its vision and goals.

- "… A wide range of distributed energy resources will be coordinated to manage load, optimize system operations, and enable clean distributed power generation."

  – Staff Straw Proposal on Track One

- Distributed energy resources (DER):
  - Energy efficiency
  - Demand response
  - Distributed generation
  - Distributed storage

Fundamental Premise in the Recommendations

- In order to meet the Commission's goals, all components of the DER benefit-cost analysis must be designed in a way that is consistent with those goals:
  - The choice of screening test.
  - Accounting for relevant costs.
  - Accounting for relevant benefits, including those associated with policy goals.
  - The choice of discount rate.
- Clearly articulated policy goals:
  - Provide low-cost electricity services
  - Empower customers
  - Animate the markets for distributed energy resources
  - Improve system efficiency and resource diversity
  - Ensure reliability and resiliency
  - Reduce greenhouse gas emissions

The Standard Efficiency Screening Tests

	Participant Test	RIM Test	Utility Test	TRC Test	Societal Test
Energy Efficiency Program Benefits:					
Customer Bill Savings	Yes	---	---	---	---
Avoided Energy Costs	---	Yes	Yes	Yes	Yes
Avoided Capacity Costs	---	Yes	Yes	Yes	Yes
Avoided Transmission and Distribution Costs	---	Yes	Yes	Yes	Yes
Wholesale Market Price Suppression Effects	---	Yes	Yes	Yes	Yes
Avoided Cost of Environmental Compliance	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (utility perspective)	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (participant perspective)	Yes	---	---	Yes	Yes
Non-Energy Benefits (societal perspective)	---	---	---	---	Yes
Energy Efficiency Program Costs:					
Program Administrator Costs	---	Yes	Yes	Yes	Yes
EE Measure Cost: Program Financial Incentive	---	Yes	Yes	Yes	Yes
EE Measure Cost: Participant Contribution	Yes	---	---	Yes	Yes
Non-Energy Costs (utility, participant, societal)	---	Yes	Yes	Yes	Yes
Lost Revenues to the Utility	---	Yes	---	---	---

Implications of the Standard Tests

Test	Key Question Answered	Costs and Benefits Included	Implications
Societal Cost Test	Will there be a net reduction in societal costs?	Costs and benefits experienced by all members of society.	Most comprehensive. Best able to account for all energy policy goals.
Total Resource Cost Test	Will there be a net reduction in costs to all customers?	Costs and benefits experienced by all utility customers, including program participants and non-participants.	Indicates the full incremental costs of the resource. Generally includes full societal costs but not full societal benefits.
Utility Cost Test	Will there be a net reduction in utility system costs?	Costs and benefits to the utility system as a whole, including generation, transmission, and distribution impacts.	Indicates the impact on average customer bills.
Participant Cost Test	Will there be a net reduction in program participant costs?	Costs and benefits experienced by the customer who participates in the program.	Of limited use for cost-effectiveness screening. Useful in program design to understand and improve participation.
Rate Impact Measure	Will there be a net reduction in utility rates?	Costs and benefits that will affect utility rates, including utility system impacts plus lost revenues.	Should not be used for cost-effectiveness screening. Does not provide useful information regarding rate impacts or customer equity impacts.

Fixing the Screening Tests

- Standard cost-effectiveness tests fail to capture full value of resources
  - Too narrowly defined
  - Hard-to-quantify costs and benefits are ignored
  - Benefits associated with energy policy goals are not necessarily captured
- The Resource Value Framework
  - Developed by several efficiency experts to address the limits of the standard tests.
  - Requires the application of several key principles:
    - Screening should identify those resources that are in the public interest.
    - Screening should account for energy policy goals of the state.
    - Screening practices should ensure that tests are applied symmetrically.
    - Hard-to-quantify impacts should not be ignored.
    - Screening practices and assumptions must be transparent.
  - Supported by dozens of organizations.
  - Can be applied differently across different states, to reflect the specific goal of each state.

Tests to Use for the Benefit-Cost Analysis

Staff proposed that the results of three test be reported:

- The Societal Cost Test
  - Staff implied that this should be the primary test.
- The Utility Cost Test
  - Will provide information on the impacts on total system costs and average customer bills.
- The Rate Impact Measure Test
  - Should not be used for screening distributed energy resources.
  - Better approaches for analyzing rate impacts are available.

Recommendations:

- Use the Societal Cost test – is most consistent with the Commission's stated goals.
- Report the results of the Utility Cost test – for the purpose of understanding bill impacts.
- Do not use the RIM test – better options should be used.

Problems with the RIM Test

The RIM Test should not be used for screening DER.

- Meaningless
  - Does not provide any meaningful information about the magnitude of rate impacts, or customer equity.
- Misguided
  - Will not result in lowest costs to customers.
- Inappropriate
  - Includes sunk costs, which should not be used for choosing new resource investments.
- Misleading
  - Results suggest that customers will be exposed to new costs, which is not true.
- Incorrect
  - Often overstates the amount of revenues actually lost.

Other approaches should be used to assess rate and equity impacts.

Better Options for Assessing Rate Impacts

- A thorough understanding of rate impacts requires a comprehensive analysis of three important factors:
  - Rate impacts, to provide an indication of the extent to which rates for all customers might increase.
  - Bill impacts, to provide an indication of the extent to which customer bills might be reduced for those customers that install distributed energy resources.
  - Participation impacts, to provide an indication of the portion of customers that will experience bill reductions or bill increases.
    - Participating customers will generally experience bill reductions, while non-participants might see rate increases leading to bill increases.
- Taken together, these three factors indicate the extent to which customers will benefit from distributed energy resources.
- Participation impacts are also key to understanding the extent to which distributed energy resources are being adopted over time.

Universe of DER Impacts

	BENEFITS			COSTS	
		Category	Examples	Category	Examples
Impacts on All Customers	1	**Load Reduction & Avoided Energy Costs**	Avoided energy generation and line losses, price suppression	1 **Program Administration Costs**	Program marketing, administration, evaluation; incentives to customers
	2	**Demand Reduction & Avoided Capacity Costs**	Avoided transmission, distribution, and generation capacity, price suppression	2 **Utility System Costs**	Integration capital costs, increased ancillary services costs
	3	**Avoided Compliance Costs**	Avoided renewable energy compliance costs, avoided power plant retrofits	3 **DSP Costs**	Transactional platform costs
	4	**Avoided Ancillary Services**	Regulation, reserves, energy imbalance		
	5	**Utility Operations**	Reduced financial and accounting costs, lower customer service costs		
	6	**Market Efficiency**	Reduction in market power, market animation, customer empowerment		
	7	**Risk**	Project risk, portfolio risk, and resliency		
Participant Impacts	1	**Participant Non-Energy Benefits**	Health and safety, comfort, tax credits	1 **Participant Direct Costs**	Contribution to measure cost, transaction costs, O&M costs
	2	**Participant Resource Benefits**	Water, sewer, and other fuels savings	2 **Other Participant Impacts**	Increased heating or cooling costs, value of lost service, decreased comfort
Societal Impacts	1	**Public Benefits**	Economic development, reduced tax burden	1 **Public Costs**	Tax credits
	2	**Environmental Benefits**	Avoided air emissions and reduced impacts on other natural resources	2 **Environmental Costs**	Emissions and other environmental impacts

Accounting for the Impacts - I

1. Direct monetization.
   - The preferred approach wherever possible.
   - Markets can be used to indicate the monetary value of several key benefits.
2. Proxies.
   - An explicit recognition that a particular impact should not be ignored and should be approximated using the best information available.
   - Can be applied in several forms: multiplier on avoided costs, multiplier on electricity saved, multiplier on participants served.
   - Can be developed at different levels of granularity: portfolio level, resource level, sector level, program level, or impact level.
   - Have been used by some states for energy efficiency screening purposes.
3. Alternative screening benchmarks.
   - Use a pre-determined benefit-cost ratio benchmark less than 1.0, to reflect benefits that are not accounted for with monetization or proxies.
   - Can be much less detailed than proxies.

Accounting for the Impacts - II

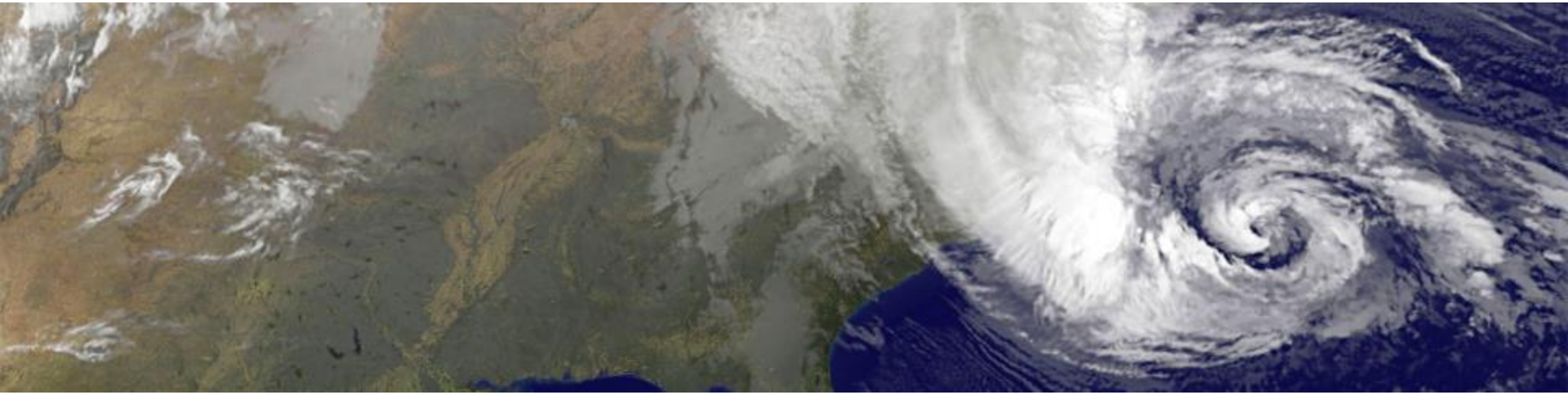
4. Regulatory judgment.
   - Allows regulators to make cost-effectiveness determinations by qualitatively considering: (a)the specific DER being analyzed; (b) the monetized impacts of that DER; and (c) the non-monetized impacts of the DER.
   - Should use the greatest amount of monetized and quantified information available.

5. Multi-attribute decision analysis
   - A systematic process for weighting and scoring both monetized and non-monetized criteria in order to rank several options across all criteria.
   - Requires some regulatory judgment with regard to weights.
   - Care must be taken to prevent inappropriate manipulation.

NORMALIZED DATA	Net Present Value of Monetized Costs and Benefits		Contribution to Market Animation		Economic Development (Job-Years)		Non-Monetized Environmental Benefits		Overall Score
	Normalized	*Weight*	*Normalized*	*Weight*	*Normalized*	*Weight*	*Normalized*	*Weight*	
Alternative A	$0.41	0.65	0.14	0.15	0.13	0.10	0.17	0.10	**0.32**
Alternative B	$0.31	0.65	0.43	0.15	0.48	0.10	0.33	0.10	**0.35**
Alternative C	$0.28	0.65	0.43	0.15	0.38	0.10	0.50	0.10	**0.33**

Risk

- Distributed energy resources offer several risk benefits, including:
  - Fuel price hedge
  - Resource diversity
  - Optionality in investment timing (fast, small increments, flexible)
  - Resiliency
    - Geographic diversity
    - Less dependent on centralized grid
    - Ability to cope with stress on the system (storms, peak demand, emergency outages)



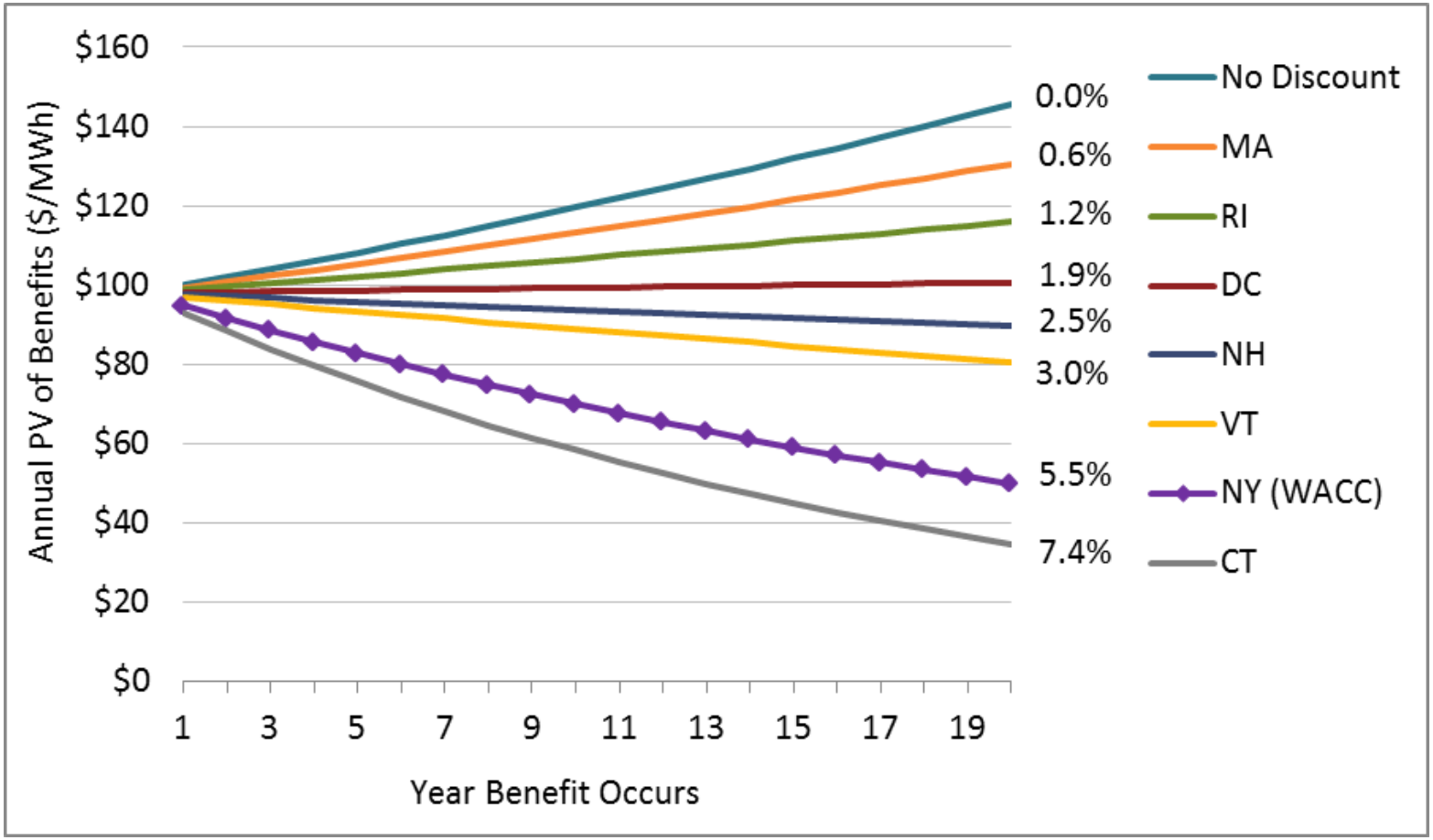
Discount Rates Used for EE Screening

States have chosen a variety of different discount rates for energy efficiency screening – both in terms of the basis for the rate, and the value of the rate.

	Primary Test							
	UCT	Total Resource Cost Test					Societal Cost Test	
	CT	NY	NH	RI	MA	DE	VT	DC
Basis for Discount Rate	Utility WACC	Utility WACC	Prime Rate	Low-Risk 10 yr Treasury	Low-Risk 10 yr Treasury	Societal Treasury Rate	Societal	Societal 10 yr Treasury
Current Discount Rate (Real)	7.43%	5.50%	2.46%	1.15%	0.55%	TBD	3.00%	1.87%

Discount Rate Implications

Discount rates from the previous slide are applied to a hypothetical (but realistic) stream of future benefits.



Discount Rate - Concepts

- The discount rate should reflect the appropriate "time preference."
  - i.e., the relative importance of short- versus long-term benefits.
- The purpose of the benefit-cost analysis is to identify those resources that meet a set of regulatory goals:
  - Reduced costs, increased system efficiency, improving reliability and resiliency, mitigating risks, reducing carbon emissions, animating markets, empowering customers.
- The discount rate chosen must reflect a time preference that is consistent with these regulatory goals.
  - Otherwise, the BCA will not lead to resources that meet these goals.
- The discount rate chosen must reflect a time preference that is relevant to all utility customers as a whole:
  - Not the utility investors' time preference.
  - Not any one customer's time preference.
  - Should be the regulators' time preference: i.e., what is in the public interest?

Discount Rates – Recommendations

- Risk benefits should be considered in choosing a discount rate.
  - If risk benefits are addressed through other means (e.g., proxies), then they should have less impact on the choice of discount rate.
- The utility weighted average cost of capital should not be used to set the discount rate for the DER benefit-cost analysis.
  - Utility investors have a different time preference than regulators.
- A societal discount rate should be used for the DER benefit-cost analysis.
  - This rate is consistent with a time preference that best reflects the Commission's goals.
  - Will apply greater weight to benefits in later years.
- Societal discount rates tend to range from 0% to 3% real.
  - Risk benefits should help determine what rate to use within this range.
- The same discount rate should be used for the Utility Cost Test.
  - Because a societal discount rate is most consistent with the Commission's goals.

Bringing It All Together

Sample Templates

Example: Choice of Valuation Methodology

Party Impacted	Benefits		Valuation Method		
	Benefit Category		Monetization	Proxy	Multi-Attribute
Utility Customers	1	Load Reduction & Avoided Energy Costs	yes	---	---
	2	Demand Reduction & Avoided Capacity Costs	yes	---	---
	3	Avoided Compliance Costs	yes	---	---
	4	Avoided Ancillary Services	yes	---	---
	5	Utility Operations	yes	---	---
	6	Market Efficiency	---	---	yes
	7	Risk	---	yes	---
Participants	8	Participant Non-Energy Benefits	---	yes	---
	9	Participant Resource Benefits	yes	---	---
Society	10	Public Benefits	yes	---	yes
	11	Environmental Benefits	yes	---	yes

Example: Present all Impacts in One Place

Monetized Impacts (Direct Monetization or Proxy Values)					
Perspective	**Benefits**	**Present Value**		**Costs**	**Present Value**
Utility Customers	Avoided Energy Costs	$	-	Program Administration, Marketing, Evaluation	$ -
	Avoided Line Losses	$	-	Incentives Paid to Participants	$ -
	Avoided Generation Capacity Costs	$	-	Capital Costs	$ -
	Avoided Decommissioning	$	-	Increased Energy Costs	$ -
	Wholesale Market Price Suppression	$	-	Increased Environmental Compliance Costs	$ -
	Avoided T&D Costs	$	-	Integration Costs - Distribution	$ -
	Avoided Environmental Compliance Costs	$	-	Integration Costs - Transmission	$ -
	Avoided Ancillary Services	$	-	Integration Costs - Ancillary Services	$ -
	Reduced Utility Operations Costs	$	-	Distribution System Platform Costs	$ -
	Proxy Value of Risk Benefits	$	-		
	Total Benefits to Utility Customers	**$**	**-**	**Total Costs to Utility Customers**	**$ -**
Participants	Other fuel savings	$	-	Capital Costs	$ -
	Water & Sewer	$	-	Annual O&M Costs	$ -
	Proxy Value of Non-energy benefits	$	-	Proxy Value of Transaction Costs	$ -
	Proxy Value of Non-energy benefits	$	-	Proxy Value of Non-Energy Costs	$ -
	Total Participant Benefits	**$**	**-**	**Total Participant Costs**	**$ -**
Society	Tax impacts from public buildings	$	-	Tax credits	$ -
	Total Societal Benefits	**$**	**-**	**Total Societal Costs**	**$ -**
TOTAL	**Total Monetized Benefits**	**$**	**-**	**Total Monetized Costs**	**$ -**
	Utility System Net Present Value:	$	-	**Utility System Benefit-Cost Ratio:**	
	Societal Net Present Value:	$	-	**Societal Benefit-Cost Ratio:**	

Non-Monetized Impacts		
Perspective	**Impact**	**Quantitative Values or Comments**
Utility Customers	Contribution to Market Animation	e.g., program expected to promote market for rooftop PV
Society	Economic development	e.g., job-years, or gross state product impacts
	Reduced environmental impacts	e.g., impacts of CO_2 emissions not monetized above
	Increased environmental impacts	e.g., increased CO_2 emissions from fossil generation from DR

Example: Applying MADA to Reach a Conclusion

RAW DATA	Net Present Value of Monetized Costs and Benefits		Contribution to Market Animation		Economic Development (Job-Years)		Non-Monetized Environmental Benefits	
	(Millions)	*Weight*	*(Qualitative Score)*	*Weight*	*(Estimate)*	*Weight*	*(Qualitative Score)*	*Weight*
Alternative A	$1.47	0.65	Low (= 1)	0.15	615	0.10	Low (= 1)	0.10
Alternative B	$1.11	0.65	High (= 3)	0.15	2189	0.10	Med (= 2)	0.10
Alternative C	$0.98	0.65	High (= 3)	0.15	1753	0.10	High (= 3)	0.10

NORMALIZED DATA	Net Present Value of Monetized Costs and Benefits		Contribution to Market Animation		Economic Development (Job-Years)		Non-Monetized Environmental Benefits		Overall Score
	Normalized	*Weight*	*Normalized*	*Weight*	*Normalized*	*Weight*	*Normalized*	*Weight*	
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